Operation and maintenance service provision in uncertain times – the case of the FLSmidth Group during the Arab Spring

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Teaching Note

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Summary of the case:

This is the story of the FLSmidth Group, a Danish cement production technology firm, seeing servitization as a strategic solution to their stagnating product sales. Targeting their Operations and management (O&M) services at North African customers, the FLSmidth Group has seen a steady growth in their service business from 2007 to 2011, when the Arab Spring with its political, economic and social instability hit the area. This case describes what happened and what actions the FLSmidth Group took with one of their plants in Egypt.

The first half of the case gives the market opportunity and the operating model for the O&M services which includes a triadic set-up between FLSmidth, NLSupervision and the Customer. The second half discusses the issues FLS faced once the Arab Spring hit their business. These issues resulted in problems with regard to production continuity and relationship continuity with their customer. The company's strategy and answers to these issues are explained. The descriptions are based on interviews with all three involved companies and secondary data from the service partners such as publications from their homepages, company meetings and marketing material.

Target audience:

The overall theme of this case is Operations and Maintenance (O&M) service provision, the challenges that are provided by crossing national and cultural boundaries and the influence of external challenges such as the Arab Spring on the continuation of the O&M operations. The target students should be bachelor and master students studying general management, service operations, risk or crisis management. Some specific discussion points of the case – specifically related to the service arrangement and set-up - also lend themselves for an executive audience. The disciplines involved are service operations management and risk or crisis management. This case can be used in the following courses;

- **Service operations** to highlight the processes involved in providing O&M services and build Business-to-Business (B2B) relationships as well as the unique challenges of service triads;
- **Risk management** to discuss issues of responding to external, unforeseeable events that disrupt operations such as the Arab Spring;

Teaching approach

Depending on the focus of the course, the specific learning objectives and discussion topics and questions differ. This case was test-taught in a risk management course with engineering students in Denmark. The students thus knew the FLSmidth Group by reputation, and had a specific

background in technical management. However, the technical background was not necessary for the students to work with the case. If the students are not familiar with FLSmidth, it would be suitable for them to study the company's homepage prior to discussing the case in class

This teaching note outlines the suggested topics for discussion with regard to different possible course types. It is suggested to start the class discussion with a general summary of the core points of the case regarding the content of the specific course. This activates the students and provides an easy start into the class discussions.

Teaching approach in service operations course:

After having read and discussed this case, the student will be able to:

1. Identify company's motivation to change their organisation strategy and provide operations and maintenance (O&M) services.
2. Discuss the different types of Product-Service Systems in the context of O&M provision.
3. Describe the difference between Business-to-Business (B2B) and Business-to-Consumer (B2C) service arrangements.
4. Discuss the specific challenges in service triads.

The lecturer may focus on the need to establish a working operating model such as a service triad in order to provide B2B services internationally. There may be class discussions on the requirements to incorporate a service business into a traditionally manufacturing business focus. What capabilities and resources are necessary to accomplish the goal of becoming a servitized manufacturer? Further, there are ample possibilities for discussing the difficulties establishing a service business in high-risk environments such as the Middle East and North Africa.

The discussion of these topics should last around 45minutes – 1 hour. The teaching approach could be organised in two different ways. One option would be to discuss the questions listed below in the cohort as class discussion. The students would be encouraged to critically reflect on the different topics and discuss different options in class. Another option would be to divide the class into sub-groups of 4-6 persons per sub-group. Each of these sub-groups discusses one of the questions listed below and presents their response to the class. Reflective questions could then be taken in class.

The following questions are suggested for discussion in class.

- **What were FLSmidth's reasons for following an O&M service strategy?**

  This could be raised as a first open question in class. To answer this question, the students could be encouraged to raise some general knowledge about the world economy prior to

2007, globalisation and market challenges in general. Another option would be to refer to key literature in the area of servitization such as Vandermerwe & Rada (1988) or Wise & Baumgartner (1999). The raised points could then be applied to this specific case of the FLSmidth Group. The main reasons include the following:

- **Financial**: stable income for contract period with regular payments; capital-intensive business of building cement plants: between $200 million and $400 million with a writing-off period of 30-40 years led to reduced equipment sales after 2008 (global economic crisis). Furthermore, increasing numbers of competitors from countries with low production cost such as China, India and Brazil enter the market. Their offerings are typically lower cost than comparable products from European and North American producers. This lowered sales of products and equipment and ultimately the profitability of the manufacturing businesses in Europe and North America.

- **Operational**: In the manufacturing industry, competitive advantage can be retained by innovation. Offering new products with high technology first can secure the position on the market. Thus, Research and Development (R&D) are important functions in production companies. O&M services provide access to information about operation of their equipment leading to possibility of improving product design and new innovations, test of prototypes

- **Environmental**: The O&M agreement includes clauses on reduced energy use during the cement production. FLSmidth are required to monitor the use of electricity, gas as well as additional chemicals needed in the production process and receive bonus payments when these measurements are below the agreed threshold. This sets an incentive for the company to continuously reduce the environmental impact of their cement production process.

Following this, the specific setting in the cement industry and the FLSmidth group can be discussed. FLSmidth identified the need for change mainly from the following two points:

- Market pressures: Increasing competition from lower price manufacturers of equipment and complete plants in a low-technology market meant that sales and profit margins were shrinking for FLSmidth. Additionally, the existence of large companies as established players on the market with stable market shares both for product sales and O&M service provision especially in large scale cement production with multiple-line plants meant that parts of the cement business were blocked to FLSmidth. Demand for cement comes particularly from developing and emerging economies that invest into their infrastructure. Thus, countries such as Egypt saw increasing investments in small cement plants with one or two production lines. These investors often did not have the capability to operate and maintain their new plants which opened a market opportunity to FLSmidth.

- Reflection on their skills and capabilities: The continuous research and development FLSmidth does regarding the effectiveness of their equipment meant that they had accumulated a wealth of knowledge in identifying sources of failures and continuous improvement in the plant operation. This knowledge lent itself to be applied in the operation phase of their cement plants.

FLSmidth earn benefits in relation to these three points, but they also deliver value to the customer. The typical idea is that the producer of equipment can operate it more efficiently due to the specialist knowledge they possess as shown in Figure 1. An experienced owner of a cement plant can (potentially) operate the plant at close to 100% capacity, meaning that unscheduled breakdowns occur rarely and material can be processed according to estimates. Due to their knowledge in the field, their direct link to product sales and their R&D facilities, FLSmidth argues that they can continuously increase the actual production to above 100% of the plant's capacity. The use of raw materials including electricity and gas can be minimised, emissions can be reduced and the continuous functioning of the plant guaranteed.

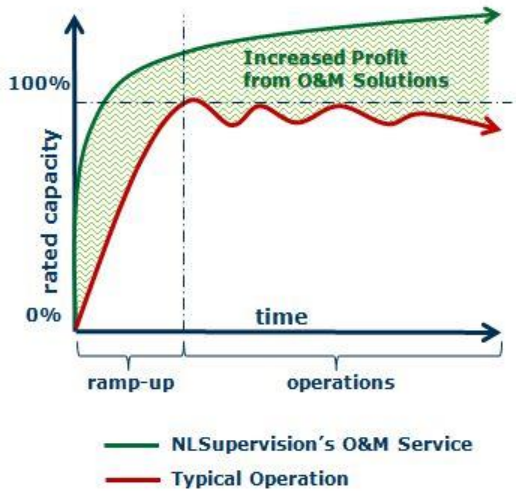

Figure 1: FLSmidth value proposition

- **What is FLSmidth's O&M service strategy?**

FLSmidth provide performance-based services where they get paid per tonne of delivered cement. Based on Oliva and Kallenberg (2003)'s product-service continuum, FLS value propositions focuses on results-oriented offerings (see Figure 2). This means that the O&M business is completely FLSmidth's responsibility, including the operation of the production process, planned maintenance of the equipment, servicing of emergency repairs and breakdowns, management of spare parts as well as administration and financial handling. The customer is responsible for delivering raw material such as clay, stone, gas and electricity to the plant and receives bagged cement in return.

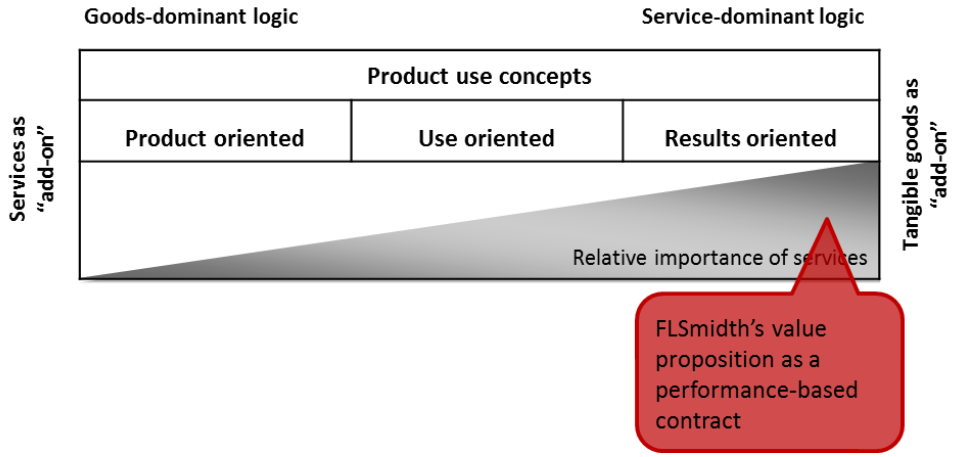

Figure 2: FLSmidth's strategic position in the product-service continuum

Discussions could arise around other possibilities for FLSmidth's O&M service business. What advantages and disadvantages would these other possibilities have for the company? Examples are to deliver only part of the production activities, e.g. clinker production, where the customer takes over the production of the actual cement. This would involve lower levels of production activities, fewer machinery to be operated and maintained, fewer staff etc. Such discussion could touch on the points listed in

Table 1.

Table 1: Alternative O&M service offerings for the FLSmidth Group

	Product-oriented	**Use-oriented**
Description and examples (based on Tukker (2004)	The service is sold as an add-on to the product and support the customer during the product's use phase. Examples are: • Maintenance contract for repairs and scheduled inspections • Consultancy on most efficient use of the plant	The customer customer purchases the ability to use the plant thorugh, for example: • Leasing of the equipment • Renting of the plant or equipment • Shares the plant or equipment with other customers
Advantages for the FLSmidth Group	The market risk lies with the customer. The FLSmidth Group can develop the relevant capabilities slowly by establishing the logistics in Egypt, Limited operational dependence on the customer and the cement market	The market risk lies with the customer. The FLSmidth Group accepts financial risks related to the life cycle of the cement plant or equipment
Disadvantages for the FLSmidth Group	Lower revenue streams with lower profit margins; Easier imitation by competition Local service organisation (i.e. NLSupervision still needed to provide the font-line support)	Not suitable for the market condition in Egypt because the local investors have the necessary financial means to purchase the cement plant.

- **The case describes a Business-to-Business (B2B) relationship of O&M provider and their customer. How does this differ to a Business-to-Consumer (B2C) service relationships?**

  This question could be particularly relevant if prior course content focused on B2C relationships. Students can also draw insights from their own experiences which should encourage an exciting debate even without such prior focus on B2C services.
  The points to discuss here can be:

  - The relational character of B2B services (Building of long-term service relationships over multiple years) vs. the transactional character of B2C services (the service is delivered often in ad-hoc service encounters) (Dwyer et al. 1987)
  - Relationships are reciprocal for B2B services and typically one directional for B2C services (Bejou & Palmer 1998).
  - Provider and customer processes become intertwined and interdependent in B2B services while in B2C services the customer impacts the provider's processes only during the service encounter (Kreye et al. 2015)

- **What is the FLSmidth Group's model for providing O&M services in Egypt? Why did they follow this model?**

FLSmidth follow an approach that involves a triadic relationship between themselves, their Egyptian service provider NLSupervision and their customer (shown in Exhibit 4 in the case description). Class discussion can focus on the three companies' roles within the triad, their motivations to enter this triad set-up and potential risks for them. This can be used to induce theory on service triads from this specific case. Table 2 shows some points for this question to direct the class discussion.

Table 2: The service triad of the FLSmidth Group

	FLSmidth	**NLSupervision**	**Customer**
Role (according to Wynstra et al. (2015))	Buyer of front-line service activities for plants in Egypt	Supplier of front-line service activities for plants in Egypt	Customer as receiver of service outputs
Motivation to engage in triad	Expansion of their business model to include O&M for installed plants; Stabilise cash flow from regular service activities as opposed to cyclical product sales; Information access for operation phase of their equipment	Core task and capability: O&M provider; core business	Outsourcing of non-core activities (no need to higher relevant engineers, acquire relevant expertise etc.) Operational benefits due to expertise of O&M provider giving the possibility of operating plant at 110% of capacity and hence increased output
Risks within triad	Cultural differences between employees in Denmark and Egypt in terms of, for example, safety attitudes Potential to lose bridge position between supplier and customer due to their direct involvement (Li & Choi 2009)	Need to bridge the cultural and geographical gap between Egypt and Europe on an operational basis Dependence on inputs from Customer and FLSmidth	Inability to influence product quality (i.e. the quality of the cement sold on the market) because product quality dependent on provider expertise and operations Lack of production expertise for core value proposition

Teaching approach in risk and crisis management course:

After having read and discussed this case, the student will be able to:

1. Produce a risk assessment for the impact of an external event on an organisation's operations.
2. Interpret the outcome of a risk assessment and determine suitable directions for decision making.
3. Reflect critically on the advantages and challenges of doing a risk assessment.
4. Identify suitable approaches for solving a crisis situation.

The lecturer may focus on various risk-related issues highlighted in the case description. A specific focus could be placed on the high risk caused by the Arab Spring in terms of person safety and business operability influencing the service operations from FLS.

The following questions are suggested for discussion in class.

- **Analyse the strengths, weaknesses, opportunities and threats (SWOT) of FLSmidth's service business in Egypt during the Arab Spring.**

  This exercise can function well as an introduction for analysing the case. This exercise was tested by the author in class. The same exercise can be fulfilled in a setting before the Arab Spring (to focus on the cross-national and triad set-up of the O&M business). The discussion was set-up as a risk assessment where the teacher was the chairperson who collected the class' analysis. The exercise started with an empty document for the SWOT analysis which was filled throughout the exercise. Table 3 gives an example of the result of a SWOT analysis. Different results can be achieved depending on the class' background and focus.

Table 3: Example of a SWOT analysis

	Positive	**Negative**
Internal	**<u>Strengths:</u>** Safety: • Existing safety standards from Europe that follow European health and safety (H&S) regulations and implementation on the plants Economic: • Stability of financial funds due to diverse portfolio (internationally and strategically between product and service offers) and head office in Denmark Operational: • High levels of staff engagement (expatriates and local staff) through advanced HR practices including skill and personal development courses and workshops • Good career opportunities for Egyptian staff within NLSupervision Strategy: • Strong positive reputation of FLSmidth on global cement production markets as a provider of high-quality equipment • High amount of technical knowledge of FLSmidth regarding plants	**<u>Weaknesses:</u>** Safety: • Difficulty to ensure safety of expatriates and their families in Egypt during unrests • Difficulty to ensure staff safety during travels to the plant • Challenges of staff availability during curfew due to extended travel times to and from the plants Economic: • Reduced financial income and even losses through contractual set-up in performance-based payment in combination with reduced production output as well as force majeure leading to a lack of customer compensation payments Operational: • Reduced availability of operational staff due to national protests in Cairo • No availability of expatriates (i.e. management staff) for short periods during unrests • High dependence on gas and an energy source in the production • Reduced production output due to reduced availability of gas and electricity supplies Strategy: • Limited strategic capabilities in Egypt creating challenges of staff availability during curfew due to extended travel times to and from the plants
External	**<u>Opportunities:</u>** Theory on emerging economies Safety: - Economic: • Potential for economic and political liberalisation (Sheth 2011) through the Arab Spring • Potential for ending the history of political oppression in Egypt as it was under "emergency law" for five decades that indefinitely suspended most constitutional rights and freedoms and gives government extreme powers (Youssef 2011) Operational: • Potential for reducing the impact of governmental institutions on business operations (Bishara 2011), especially with	**<u>Threats</u>** Safety: • Challenges for personal safety on roads and in Cairo • National curfew from August – November 2013 confiding Egyptians to their homes between 7pm and 6am to reduce violence and increase military control of the situation Economic: • Unexpected length of Arab Spring and effects on economy and political developments leading to political and economic instability, • Gas and electricity provision to the plants unavailable or disrupted Operational: • Disruptions to production due to

	regard to energy and gas distribution. This could simplify processes for getting access to the grid for plants that are situated in the desert. • Extended possibilities for increasing efficiency and effectiveness of interactions with suppliers in Egypt, e.g. energy, gas and other local institutions Strategy: • Increased business potential in the future through improved business opportunities and availability of funding	lacking or reduced availability of electricity and gas • Reduced staff availability due to attendance of national protests in Cairo Strategy: • Unknown level of severity of the Arab Spring and impact on service operations • Extensiveness of the revolution in terms of geography, time, and impact on daily lives • Raises question of continued O&M business model in North Africa

- **What were "uncertain times" for the FLSmidth Group?**

  Uncertainty arose from the Arab Spring and the instability it caused for the whole region in terms of the political and economic future. This caused much organisational uncertainty for the FLSmidth Group. Specifically, the following uncertainty types can be differentiated:

  - **Economic uncertainty**: Increased instability due to disruptions caused by the demonstrations and violence in relation to the market stability, exchange rates of the Egyptian pound to other currencies, gas and electricity shortages, leading eventually to force majeure.

  - **Political uncertainty**: Lack of knowledge about the future of the political system, especially after the revolution. During the Arab Spring, Egypt has (until 2014) experienced two ousting of the government which placed the political under high uncertainty. FLSmidth needed with to be prepared for the possibility of having to evacuate their staff within days. In Egypt, gas and electricity supply is regulated by governmental bodies, meaning that political instability causes economic instability and hence instability for the operations of cement production.

  - **Organisational uncertainty**: the force majeure in the contract caused high uncertainty for NLSupervision and FLSmidth in terms of the future of the O&M business. High financial and production losses, the need to cut costs and let go of personnel placed a string on the morale of the staff and on the relationship with the customer. Furthermore, the violent and non-violent protests lead to transport issues and inability to guarantee staff safety during transport to and from the pant.

- **Do a Structured What-If (SWIFT) analysis for FLSmidth during the Arab Spring at the time when the customer called force majeure and a presidential election was lying ahead in Egypt.**

  This exercise can function to engage the whole class to identify possible scenarios and let the students analyse these with regard to consequences and likelihood. This exercise was also included in test-teaching the case. The discussion was set-up as a risk assessment where the teacher was the chairperson who collected the class' analysis. The exercise started with an empty document that included an empty table for the SWIFT analysis which was filled throughout the exercise. Table 4 gives an example of the result of a SWIFT analysis. Different results can be achieved depending on the class' background and focus.

Table 4: Example of a SWIFT analysis

What if?	Answer	Likeli-hood	Consequences	Recommendations
Safety				
The safety situation escalates in the area of the plant location and staff safety cannot be guaranteed anymore?	All plant personnel have to be evacuated, operations have to be (momentarily) terminated.	Very small	Very serious, potentially disastrous for the plant's O&M business	Monitoring of the safety situation in Egypt.
Health and safety standards on the plant diminish.	Increased number of incidents and accidents on the plant	Likely	Minor, impact can be reduced by reinforced H&S standards and refresh courses	Continuous enforcements of H&S standards and preparation of refresh courses
Economic				
The reduced financial income and losses in the medium term through e.g. the force majeure situation?	The O&M business on this plant is seriously challenged in its economic tenability.	Likely	Serious, Termination of the O&M service relationship to this customer	Cost-reduction strategies to reduce money spenditure.
The reduced financial income and losses in the long term through e.g. the force majeure situation is continued for a prolonged period of time	The O&M business on this plant is untenable as continuous losses are accrued.	Possibl e	Very serious, Termination of the O&M service relationship to this customer	Diversification to other local customers
Reduced financial income through overall reduced	The O&M business in Egypt may be untenable.	Possibl e	Very serious, O&M business in Egypt as is not tenable	Diversification to other energy sources (e.g. coal),

levels of production in Egypt due to continued low levels of availability for electricity and gas.				diversification of the O&M business to other countries
Operational				
The force majeure situation with the customer cannot be resolved successfully.	The O&M contract with this customer cannot be renewed.	Possible	Serious, Termination of the O&M service relationship to this customer	Diversification to other local customers
The use of coal mills was not made legal in Egypt and thus this alternative source of energy cannot be used by NLSupervision.	Coal mills cannot be put into operation	Possible	Serious, sunk cost of development investment	Research and investment into alternative sources of energy; Investment into gas availability in Egypt-
Some operational staff stay away from work due to, e.g. protests in Cairo	Reduced number of operational staff	Unlikely	Minor, due to low productivity	Flexibility in staff tasks
Expatriates have to be evacuated for a prolonged period of time due to problems to personal safety in Egypt	Medium and higher level management staff are not available for a long period of time	Very unlikely	Serious due to longevity of challenge	Enable local staff to undertake management tasks
Strategic				
The Arab Spring continues for years, disrupting political, economic and social processes on a long and large scale?	The O&M business in North Africa becomes untenable.	Very unlikely	Very serious, potentially disastrous for NLSupervision and the O&M service business	Diversification to other geographical areas
The Arab Spring resolves itself in the medium-term and restores the political and social institutions as prior to the demonstrations in Egypt?	The O&M service business can be continuously operated as before the Arab Spring with the option of installing resilience measures with regard to e.g. coal mills.	Possible	Minor, Operations can be taken up as before the Arab Spring	Implement coping mechanisms to overcome challenges of the Arab Spring.
After the Arab Spring resolves, international companies will have very restricted rights to do business in Egypt?	FLSmidth may not be able to offer the support for O&M contracts	Very unlikely	Very serious for the O&M business in Egypt	Diversification to other geographical areas

While test teaching this exercise, the following three observations were made:

- For some scenarios, different students disagreed on the likelihood of the events. In these situations, the students were asked to justify their assessment of the likelihood. Then, these disagreements were solved by vote in the class.
- Many of the students lacked an in-depth understanding of the political and economic setting of the Arab Spring and Egypt in general. While specific facts were less relevant for the purpose of this exercise, this could form a barrier in class and potential cause frustration with some students. No such disruptions were observed when test-teaching the class. We utilised the observations lacking in-depth understanding in the subsequent reflection on the exercise to justify, for example, that experts could be included in the risk assessment or that further analysis of the different scenarios may be needed.
- Sometimes, the discussion may stagnate as students have difficulties to come up with any additional scenarios. In this case, the teacher encouraged them to come up with "crazy" scenario, i.e. think outside of the box. This encouraged the students to identify further scenarios and continued the exercise.

➢ **Construct a risk matrix for FLSmidth during the Arab Spring at the time when the customer called force majeure and a presidential election was lying ahead in Egypt.**

For this exercise, the scenarios identified during the SWIFT analysis can be utilised and included in a matrix such as shown in Table 5. During the test-teaching of this case, this was simply copied over from the SWIFT analysis during a break. The risk matrix was then used to re-assess the likelihoods and consequences of the different scenarios. Then the students were asked to identify actions based on this risk matrix.

Table 5: Example of a risk matrix

	Minor	**Serious**	**Very serious**
Likely	Health and safety standards on the plant diminish	The reduced financial income and losses in the medium term through e.g. the force majeure situation	
Possible	The Arab Spring resolves itself in the medium-term and restores the political and social institutions as prior to the demonstrations in Egypt	The force majeure situation with the customer cannot be resolved successfully The use of coal mills was not made legal in Egypt and thus this alternative source of energy cannot be used by NLSupervision	The reduced financial income and losses through e.g. the force majeure situation is continued for a prolonged period of time Reduced financial income through overall reduced levels of production in Egypt due to continued low levels of availability for electricity and gas

Unlikely	Some operational staff stay away from work due to protests in Cairo or other reasons		The safety situation escalates in the area of the plant location and staff safety cannot be guaranteed anymore
Rarely		Expatriates have to be evacuated for a prolonged period of time due to problems to personal safety in Egypt	The Arab Spring continues for years, disrupting political, economic and social processes on a long and large scale After the Arab Spring resolves, international companies will have very restricted rights to do business in Egypt

- **Please reflect on your experience when doing the risk assessment. What did you notice? Did you make any positive or negative observations?**

  This question may be particularly relevant for a course at Master level to encourage the students to critically reflect on existing methods and their strengths and weaknesses. For the utilised exercises during test-teaching, the following points were discussed:

  - **Subjectivity** in assessing the risk: this was particularly relevant with regard to identifying the scenarios and assessing the likelihood of their occurrence. Following this criticism, strategies for reducing the impact of subjectivity during risk assessment were discussed. The included: the Delphi-method, an iterative process of risk assessment and using experts.

  - **Lack of in-depth understanding** regarding the background of the situation: the students for test-teaching this case lacked specifically any background information on Egypt (its political, social and economic context), the Arab Spring (and details of its progress), international operations and service operations. When identifying this shortcoming, the students were asked to reflect on possible solutions which included more in-depth and targeted research and involving experts.

- **How did FLSmidth recover from the disruptions caused by the Arab Spring in Egypt?**

  One approach to solving this question could be to develop a success tree. This approach was utilised in test-teaching this class and took around two hours. It is suggested to answer this question in two steps. First, we identified the relevant systems that are needed for the focal event (in this case to recover the O&M operations). This can be facilitated by the teacher as a brainstorming session based on the case description. In a second step, these systems need to be broken down into intermediate events. This exercise may also be a good opportunity to include possible recommendations from the SWIFT analysis if this exercise was held before. Figure 3 depicts an example of a success tree for recovering operations following the Arab Spring.

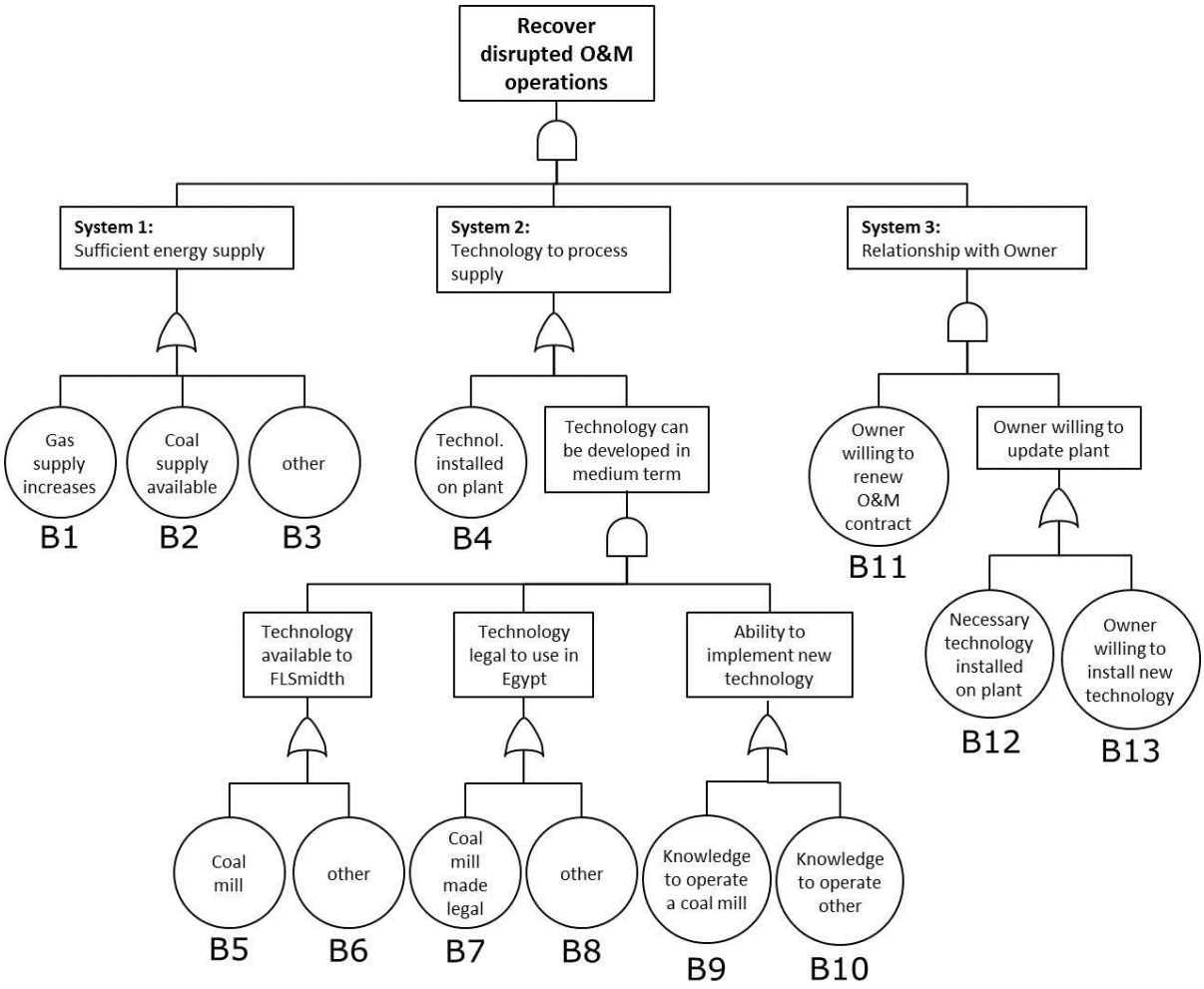

Figure 3: Success Tree for the recovery activities of the FLSmidth Group

While test teaching this exercise, the following three observations were made during the development of the success tree:

- The number of type of systems could vary between classes depending on their background. The teacher would then start the discussion asking how this system is relevant for the focal event of recovering O&M operations. This triggered a discussion in class that would lead to (a) a decision of whether this system needs to be included in the success tree and (b) which intermediate events may be relevant for this system. The teacher then explicitly asked the students to reach a consensus regarding these two issues. Where necessary this consensus was reached via vote in class to follow the majority.

- The issue of breaking systems down into intermediate events and subsequently breaking the intermediate events down further could cause some difficulty which resulted in a lack of participation by the students. This was resolved by the teacher asking What-if questions to guide the students' thinking and generate ideas. For this

purpose, it was found to be helpful if the teacher knows the class and the students' background well in order to facilitate the idea-finding process.

The success tree can be used to determine the probability of success (P(S)) as follows:

Boolean equation:

$$= [B1 + B2 + B3] \times [B4 + (B5 + B6) \cdot (B7 + B8) \cdot (B9 + B10)] \times [B11 \cdot (B12 + B13)]$$

From this equation, the minimum cut sets can be determined as follows:

$$= B1 \cdot B4 \cdot B11 \cdot B12 + B2 \cdot B5 \cdot B7 \cdot B9 \cdot B11 \cdot B13 + B3 \cdot B6 \cdot B8 \cdot B10 \cdot B11 \cdot B13$$

Following the development of the success tree and the generation of the Boolean equation, it is suggested to have a class discussion around their use in the organisational decision-making process. The students can be encouraged to reflect critically on the process (and the exercise) to identify advantages and disadvantages in supporting the decision-making process. The following areas could be informed by the success tree and hence be discussed in class:

- Assessing the probability of the individual nodes. Further discussions can evolve here around issues of collecting probabilistic information from, for example, experts. If relevant for the specific class, an "expert" (such as an external lecturer or other external person) could come into the class to evaluate the probability values. The students can then be asked to calculate the probability of success and propose activities to increase this probability. This can also be critically assessed by discussing the role of subjectivity, the lack of in-depth information regarding some of the intermediate events or similar issues in this context.
- Develop scenarios for future actions. These scenarios are logically based on the minimum cut sets as presented above. These scenarios are:

  Scenario 1: no technological changes to the plant, expectations that gas supply will incrase in the future

  Scenario 2: install a coal mill on the plant. Central issues here are the legality of the coal-mill use in Egypt (B7) and the Owner's willingness to install the new technology on the plant (B13). These events are outside of the control of the FLSmidth Group.

  Scenario 3: utilising another energy resource and installing the relevant technology on the plant. The core issues here are also the legality of the technology use in Egypt (B8) and the Owner's willingness to install the new

technology on the plant (B13). These events are outside of the control of the FLSmidth Group.

- Assessing critical factors that determine the success of the core event. This may also lead to areas where further information needs to be collected to successfully determine chances of success.
- Supporting/Enabling decision making for the FLSmidth Group. The information can be utilised to make a decision regarding whether to pull out of the O&M business in Egypt all together (if the probability of success is too low) or whether to invest resources in recovering the disrupted O&M operations.

- **How did FLSmidth manage the crisis arising from the Arab Spring in Egypt?**

This question is particularly relevant for a crisis management course. It focuses on a holistic assessment of the situation of the FLSmidth Group following the Arab Spring using relevant models of crisis management. In contrast, the questions above focus on assessing the risk to support decision making at different stages before and during the Arab Spring.

To answer this question, it is suggested to use Shrivastava's (1993) 4C model that defines causes, consequences, caution and coping as depicted in Figure 4. This can form a good starting point for class-room discussions of the different parts of the model and can thus be used to induce crisis management theory. This could also be a good foundation for dividing the class into four groups which discuss one of the model parts amongst themselves and present their insights to the rest of the class. Overlaps between the model parts such as between caution and coping mechanisms can then be taken in the class-room discussion.

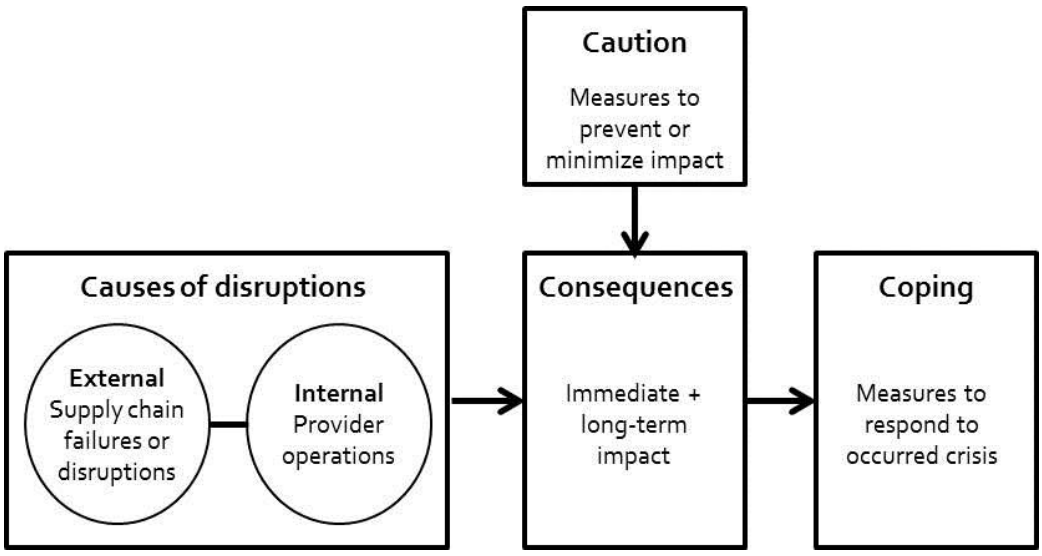

Figure 4: 4C model of Shrivastava (1993)

The suggested points for discussion are as follows:

Causes:

The external cause of the crisis for the FLSmidth Group was the Arab Spring as political unrests caused political and economic instability. Specifically, the unexpected nature and long duration of the Arab Spring challenged the O&M business. This caused problems in staff availability and safety and necessary resources for the cement production to become unavailable. For a long time, the level of severity and final impact on the O&M business was unknown to the FLSmidth Group.

Consequences:

The main consequence was the disruption of the O&M business. This could be observed in terms of production continuity and relationship continuity with the customer. The long-lasting effects are the shortage and cut-offs of electricity and gas which have significantly reduced production and output of cement. This has led to operational problems, but also to financial issues for NLSupervision, FLSmidth and their customer. Exhibit 5 shows that the financial results of the FLSmidth Group were negative due to the operational problem. Particularly the earnings margin with -95% is striking. The development of cement prices showed that their customer was in a less desperate situation than NLSupervision and FLSmidth. Given the strong rise in cement price, the customer could sell their product at higher margins, even though in reduced amounts. Thus, economic pressure lied mostly with the FLSmidth Group.

Caution:

The crisis situation emphasised the strengths and weaknesses of the FLSmidth Group. The ***strengths*** were the high levels of employee engagement in their work which kept the plant running even during the most challenging times of the Arab Spring when personal safety was a specific concern. This was due to the high level of staff engagement by the local (Egyptian) staff that operated the plant even when the expatriates were evacuated. The ***weaknesses*** were the high level of dependence on gas for the power supply on the plant (and in Egypt in general). Due to this dependence, the resource shortages resulted in immediate reduction in the production and the produced output.

Coping:

The FLSmidth Group coped with the situation by exploring a new energy source for the plant. They identified coal as a suitable alternative energy solution. This was particularly remarkable because it was a high-risk decision due to the context within Egypt. At the time they made the investment decision, the use of coal mills was legally forbidden in Egypt. The possibility of future change of this law was highly uncertain due to the level of political instability and economic uncertainty. However, coal was the best solution at the time because the FLSmidth Group had long-standing experience with the technology in Europe. Alternative options for energy could have been the use of biomass or other resources. But

these options were still experimental for the global cement industry and the FLSmidth Group and thus limited experience in using it.

- **To what extend can FLSmidth apply their response to the conditions on their plant in Cairo, Egypt, to other plants they were establishing in Tunisia and Angola?**

  This question aims at identifying the context-specific nature of recovery activities. This is an open question to encourage discussion and there are no clear right/wrong answers to this question. This question could thus be approached as a SWOT analysis to summarise the previous discussions and identify their applicability to another context. Some of the following issues could arise in the class discussion:

  - Applicable strengths of the FLSmidth Group: discussion can focus on their staff engagement and training, finding a suitable mix between local staff and expatriates. Are the solutions they found in Egypt applicable in other countries? Could plants in other countries be operated with fewer expatriates and higher number of local staff? What impact would this solution have on the competitive advantage of NLSupervision?
  - Reducing the weaknesses of their operations: dependence on specific types of resources and supply. Could this also become a problem in a country such as Tunisia or Angola? Could redundant energy sources be installed in new plants in these countries to limit the dependence? What difficulties would such an approach bear?
  - External developments: stability of other countries in the area in terms of political unrests, economic developments, safety in regular and in emergency times, level of qualification of local staff. What are the opportunities other countries may offer? Could FLSmidth face similar threats in these countries or were the developments specific to Egypt? How could FLSmidth apply their solution from Egypt to these other countries?

Timing

This case was test-taught in a risk management course with MSc students. We discussed the case on two separate points during the course. The first session took place in the beginning of the course (Day 2) and focused on risk assessment methods such as a SWIFT analysis and risk matrix. The second session took place at the end of the course and focused on decision-making under uncertainty to exemplify how different decision making models can be utilised in practice. Each of these sessions took about 1.5 hours to complete the exercises.

The inductive approach utilised in the first session of test-teaching this case could be applied in courses of crisis management or risk management where a specific example of a crisis – here related to the Arab Spring – are discussed and theoretical concepts inducted. This option is particularly useful for experienced teachers and more mature students such as MSc or MBA students. Alternatively, the case can also function as an application and summary of theory previously taught in the course. This approach was utilised for the second session of test teaching the case to show the students alternative contexts for applying the previously taught concepts.

The timing of this case within the specific course will vary depending on the specific course and student audience. Similarly, the length of discussions surrounding the specific questions will vary depending on the course content. Specific suggestions were made with respect to each of the two suggested courses: service operations, and risk and crisis management. For test-teaching the case in a risk management course, the two-part discussions took 1.5 hours respectively. This was due to the time-intensive nature of the exercises in this course. In a service operations course, the case can also be taught in one session of 45-60 minutes by focusing on the nature and challenges of service operations in class discussions.

Additional reading

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